

REMARKS

This Amendment cancels claims 16-19 and 24, and rewrites claim 1. A version showing changes made is attached as an Appendix. Claims 1-7, 9-15, 20, 21, 23 and 25-27 are pending.

Examiner Lee is thanked for indicating the allowability of claims 20, 21, 23 and 27. It is believed this Amendment places the entire application in condition for allowance for the reasons which follow.

The Examiner is also thanked for the courtesies extended to the undersigned during a personal interview held February 15, 2003. The Examiner Interview Summary Record accurately reflects the substance of the interview.

The changes made in this Amendment are identical to the changes in the proposed amendment presented to the Examiner during the interview. Accordingly, it is believed this Amendment overcomes the objection to claim ~~1~~, which has been rewritten in accordance with the Examiner's helpful suggestion. Reconsideration and withdrawal of the objection to claim 1 are earnestly requested.

The 35 U.S.C. § 112, first paragraph, rejection of ~~claim 19~~ is rendered moot by the cancellation of that claim. Reconsideration and

withdrawal of the non-enablement rejection of claim 19 are earnestly requested.

Examiner Lee is thanked for withdrawing the 35 U.S.C. § 112, second paragraph, rejection of claim 1 during the interview, as well as the 35 U.S.C. § 112, second paragraph, rejection of claims 1, 16, 18-20, 23 and 25-27. As requested by the Examiner, applicants point out that the specification lists numerous illustrative metallocene compounds, including metallocene compounds which include heteroatoms (page 4, line 12 to page 17, line 14).

Reconsideration and withdrawal of the indefiniteness rejection of claims 1, 16, 18-20, 23 and 25-27 are earnestly requested.

The 35 U.S.C. § 102(b) rejection of claims 1-7, 9-12, 16, 17 and 24-26 over PCT Patent Publication WO 98/22486 to Ewen et al. is respectfully traversed. Claim 16, 17 and 24 have been canceled. Process claims 1-7 and 9-12 are directed to the preparation of ethylene polymers using a catalyst system formed by contacting a metallocene compound of formula (I) with a compound selected from a Markush group consisting of an alumoxane and a compound capable of forming an alkyl metallocene cation. The inventors have discovered that the use of a specified halogen-containing metallocene catalyst

permits production of high molecular weight polyethylene in high yield.

Ewen et al. fails to anticipate the claimed process for polymerizing ethylene. Although Ewen et al. broadly discloses the utility of its process for polymerizing homopolymers and copolymers of vinyl monomers having from 2 to 20 carbon atoms (page 13, lines 6-12), only Example 7 is directed to ethylene polymerization, and the metallocene catalyst utilized therein - isopropylidene [cyclopentadienyl-(7-cyclopentadithiophene)] zirconium dichloride - does not come within the scope of the claimed process.

A claim is anticipated only if each and every element set forth in the claim is found, either expressly or inherently described, in a single prior art reference, Verdegaal Bros. v. Union Oil of California, 814 F.2d 628, 6312, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Although Ewen et al. generically discloses the polymerization of addition polymerizable monomers (such as α -olefins, vinyl halides, vinyl arenes, and dienes) using a broad class of metallocene catalysts, the ⁽¹⁾reference fails to specifically disclose the polymerization of a specific α -olefin (ethylene) using a metallocene of the present invention. Thus, although claim 19 of Ewen et al. recites a process for production of polyethylene, isotactic,

syndiotactic, hemi-isotactic or atactic polypropylene or copolymers thereof, it fails to specifically disclose the polymerization of ethylene using a metallocene of the present invention. A patent claim directed to a single species - polymerization of ethylene using a metallocene of Formula (I) - is not anticipated by a broad generic disclosure - such as polymerization of addition polymerizable monomers using the substituted and unsubstituted metallocenes of Ewen et al. unless one of ordinary skill in the art would "at once envisage" the claimed species. In re Petering, 301 F.2d 676, 133 USPQ 275 (CCPA 1962); MPEP 2131.02. One of ordinary skill in the art must be able to draw the presently-claimed structural formula or write the name of each of the metallocenes included in the presently-claimed structural formula, with respect to ethylene polymerization, before the claimed process can be "at once envisaged". One of ordinary skill in the art would hardly "at once envisage" using the substituted metallocenes to polymerize ethylene given the numerous other metallocenes set forth in Ewen et al. at page 4, line 12 to page 17, line 14.

Claims 25 and 26 are directed to a metallocene compound of formula (I) and its corresponding ligand of formula (II). Both claims expressly disclaim compounds disclosed by Ewen et al.

Accordingly, it is believed that these claims do not read on the reference.

Reconsideration and withdrawal of the anticipation rejection of claims 1-7, 9-12, 16, 17 and 24-26 over Ewen et al. are earnestly requested.

The claimed process for polymerizing ethylene is patentable over Ewen et al. because use of the metallocene catalysts recited by the claimed process provides surprising results which one of ordinary skill in the art would not expect in view of Ewen et al. More particularly, the catalysts employed in the claimed process exhibit unexpectedly high activity, and produce ethylene having a much higher molecular weight than would be expected by one of ordinary skill in the art.

These surprising results are demonstrated by comparison of the data in Table 1 of Ewen et al., 120 J. Am. Chem. Soc. 10786 (1998).¹ The relevant polymerization date for isopropylidene (cyclopentadienyl)-(7-cyclopentadithiophene) zirconium dichloride ("cp"), which is the sole metallocene catalyst used to polymerize ethylene in the Ewen et al. application, and isopropylidene(3-t-

¹The Ewen et al. article is used for comparison, rather than the Ewen et al. patent application, because the reaction conditions used are substantially the same. In contrast, the data in the Ewen et al. application cannot be compared.

butyl-cyclopentadienyl)-(7-cyclopentadithiophene) zirconium dichloride ("ter-cp"), which comes within the formula for the permissible metallocene catalysts of the claimed ethylene polymerization process, are set forth below:

Entry	Catalyst	Activity	Mw of Polypropylene
1	Ter-Cp	13	91
3	Cp	14	98

From this data it is clear that the ter-cp metallocene catalyst is less active than the cp metallocene catalyst, and moreover, that the ter-cp metallocene catalyst produces polypropylene having a lower molecular weight than the cp metallocene catalyst. Thus, one of ordinary skill in the art would expect that a similar relationship would result if these two catalysts were used to polymerize ethylene.

The inventors have surprisingly found that ter-cp exhibits a much higher activity when used in ethylene polymerization than cp, as

demonstrated by Examples 1 and comparative Example 8 of the present application. See also Example 3:

Example	Catalyst	Activity	IV of Polyethylene
1	ter-cp	256.9	3.97
3	CMe ₂ (Cp) (7-MeTh ₂ Cp)	306.1	3.4
8 (comp)	cp	97.7	2.6

This data is unexpected and surprising in view of the contrary data reported in the Ewen et al., and demonstrates the patentability of the claimed process for polymerizing ethylene using the specified metallocene catalysts.

The 35 U.S.C. § 103(a) rejection of claims 13-15 over Ewen et al. in view of U.S. Patent No. 5,948,873 to Santi et al. is respectfully traversed. These claims all depend from claim 1, and thus are patentable over Ewen et al. for at least the same reasons as claim 1.

Applicants have previously pointed out that one of ordinary skill in the art would not combine Ewen et al. with Santi et al. because the secondary reference discloses a different class of metallocenes. It is even more apparent that Santi et al. fails to disclose or suggest that the metallocene compounds of the claimed process exhibit significantly higher activity and produce

polyethylene of higher molecular weight than suggested by Ewen et al. when used to polymerize propylene.

Reconsideration and withdrawal of the obviousness rejection of claims 13-15 over Ewen et al. in view of Santi et al. are earnestly requested.

The 35 U.S.C. § 103(a) rejection of claim 18 over Kraak et al., 24 Tetrahedron 3381 (1968) is rendered moot by the cancellation of that claim. Reconsideration and withdrawal of the obviousness rejection of claim 18 are earnestly requested.

The 35 U.S.C. § 103(a) rejection of claim 19 over Kraak et al. in view of Elschenbroich et al., Organometallics 19-29 (1989) is rendered moot by the cancellation of that claim. Reconsideration and withdrawal of the obviousness rejection of claim 19 are earnestly requested.

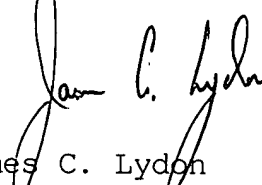
It is believed this application is in condition for allowance. Reconsideration and withdrawal of all objections and rejections of claims 1-7, 9-21 and 23-27, and issuance of a Notice of Allowance directed to claims 1-7, 9-15, 20, 21, 23 and 25-27, are earnestly requested. The Examiner is requested to telephone the undersigned should he believe any further action is required for allowance.

U.S. Patent Appln. S.N. 09/914,305
AMENDMENT AFTER FINAL REJECTION

PATENT

A Petition and fee for a one month Extension of Time, and a Request for Continued Examination, are attached. It is not believed that any additional fee is required for entry and consideration of this Amendment. Nevertheless, the Commissioner is hereby authorized to charge our Deposit Account 50-1258 in the amount of any such required fee.

Respectfully submitted,



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Enclosures:

Appendix
Petition for Extension of Time
Request for Continued Examination
Associate Power of Attorney

APPENDIX

Version Showing Changes Made

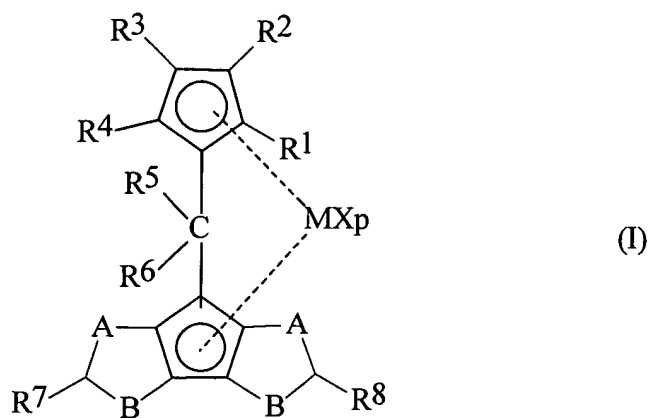
IN THE CLAIMS:

Claims 16-19 and 24 have been canceled.

Claim 1 has been rewritten as follows:

1. (Thrice Amended) A process for the preparation of polymers of ethylene comprising the polymerization reaction of ethylene and optionally one or more olefins in the presence of a catalyst comprising the product obtained by contacting:

(A) a metallocene compound of formula (I):



wherein

the rings containing A and B have a double bond in the allowed position having an aromatic character;

A and B are selected from sulfur (S), oxygen (O) or CR⁹, R⁹ being hydrogen, a C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₂-C₂₀-alkenyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl, or C₇-C₂₀-arylalkyl radical, optionally containing heteroatoms belonging to groups 13 or 15-17 of the Periodic Table of the Elements, with the proviso that if A is S or O, B is CR⁹ or if B is S or O, A is CR⁹, and A and B cannot simultaneously be CR⁹;

R¹, R², R³, R⁴, R⁵, R⁶, R⁷, and R⁸ which may be the same as or different from each other, are hydrogen, a C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₂-C₂₀-alkenyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl, or C₇-C₂₀-arylalkyl radical, optionally containing heteroatoms belonging to groups 13 or 15-17 of the Periodic Table of the Elements, and at least two adjacent substituents R¹ and R², R³ and R⁴, or R⁵ and R⁶ can form a ring comprising 4 to 8 atoms, and where at least one of R¹, R², R³, R⁴, R⁷ and R⁸ is not hydrogen;

M is an atom of a transition metal selected from group 3, 4, 5, 6 or the lanthanide or actinide groups in the Periodic Table of the Elements,

X, which may be the same as or different from each other, is [hydrogen] hydrogen, halogen atom, a R¹⁰, OR¹⁰, OSO₂CF₃, OCOR¹⁰, SR¹⁰, NR¹⁰₂ or PR¹⁰₂ group, wherein the substituents R¹⁰ are hydrogen, a

C_1 - C_{20} -alkyl, C_3 - C_{20} -cycloalkyl, C_2 - C_{20} -alkenyl, C_6 - C_{20} -aryl, C_7 - C_{20} -alkylaryl, or C_7 - C_{20} -arylalkyl radical, optionally containing heteroatoms belonging to groups 13 or 15-17 of the Periodic Table of the Elements;

p is an integer of from 1 to 3, being equal to the oxidation state of the metal M minus 2;

and

(B) at least one member selected from the group consisting of an alumoxane and a compound of formula D^+E^- , wherein D^+ is a Brønsted acid, [able to give a proton and to react] which gives a proton and reacts irreversibly with a substituent X of the metallocene of formula (I) and E^- is a compatible anion, which [is able to stabilize] stabilizes the active catalytic species originating from the reaction of the two compounds, and which is [sufficiently labile to be able to be] removed by an olefinic monomer.